EXHIBIT 12

Stablecoins — Defining the Terra Algorithmic Design

The Intern · Follow

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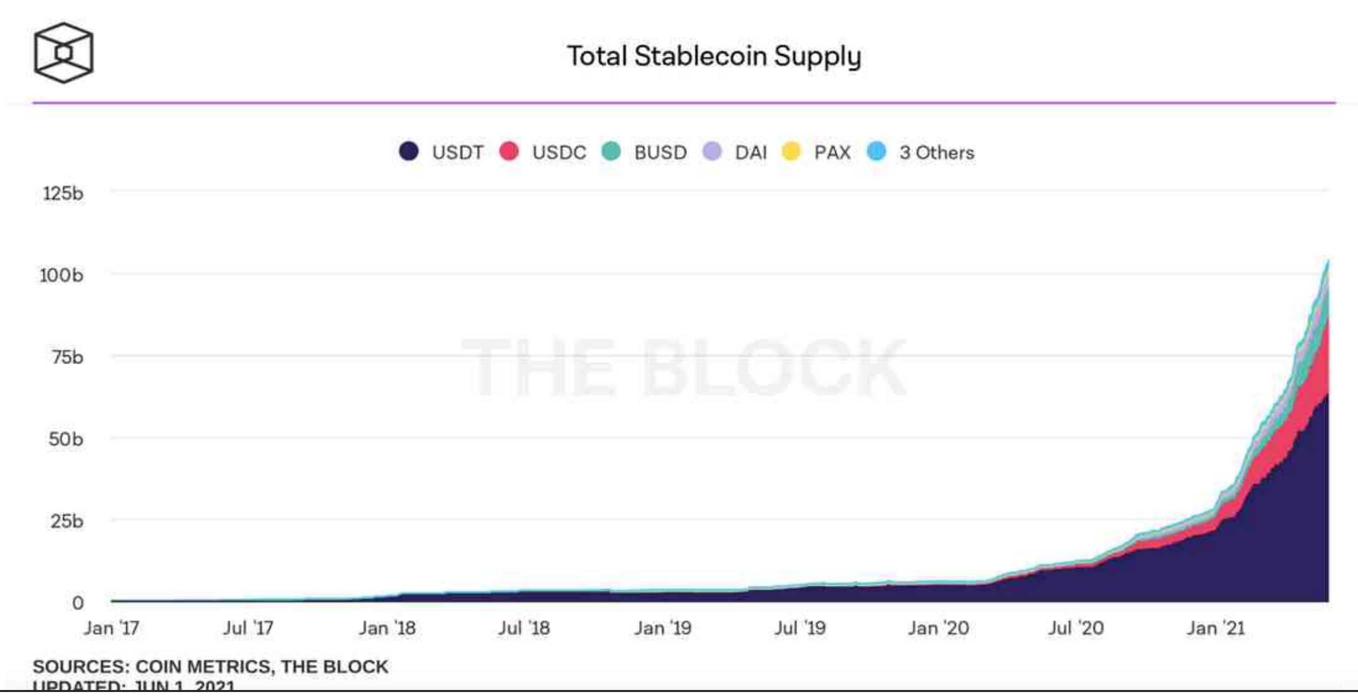
Previously, we've covered the Terra protocol's mechanics at both a high level and more technical level via core researcher Nick Platias' "Introducing the New Terra Protocol" piece, and of course, the Terra Whitepaper — both of which have become slightly outdated.

In this piece, we will synergize the efforts of previous essays defining the Terra protocol while also allaying misconceptions and providing context on recent developments and how they impact the protocol's evolution.

Narratives are the thread that binds communities. So without further ado, we're pleased to present the Terra protocol in a new light — a special edition


Total Stablecoin Supply
USDT
USDC
BUSD
DAI
PAX
3 Others
125b
100b
75b
50b
25b
0
Jan '17
Jul '17
Jan '18
Jul '18
Jan '19
Jul '19
Jan '20
Jul '20
Jan '21
THE BLOCK
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anywhere over the internet with strong finality and few of the encumbrances of the traditional banking system."

Dubbed the "Holy Grail of Cryptocurrencies," stablecoins offer a global user set an intuitive way to understand the benefits of price-stable cryptographic tokens — something at Terra we believe can function as a gateway to the mass adoption of DeFi applications.

At a cursory glance, it may seem like price-stable cryptocurrencies are simply fiat currencies on blockchains, tilting at a use case under the looming shadow of central banks and political leverage. But when you dive into the

designing peg mechanisms that can withstand extreme volatility at a low cost.

The latter point is essential. A stablecoin peg design infused with robust defenses against volatility at a minimal cost can adequately scale to the levels necessary for a price-stablecoin cryptocurrency to garner mass adoption in the hostile environment of the Internet. As a result, stablecoins that are censorship-resistant and can scale to mass adoption need to be:

- **Decentralized**
- **Maintain Robust Peg Assurances Amid Volatility**

of the balance sheet. The mint/redemption mechanism often serves as the locus of the overall mechanism design, from which open market incentives are derived.

Whether the mint/redemption mechanism is programmatic (algorithmic), operated by siloed, over-collateralized debt positions (crypto-collateralized), or administered by a third-party exogenous to the blockchain (custodial), stablecoins make candid trade-offs in varying degrees to achieve price-stability — the first and primary goal of any stablecoin worth its chops.

Custodial Stablecoins

The above mechanism induces a distinct incentive to maintain the peg. Since prospective arbitrage traders can always mint/redeem USDC at Circle 1:1, they can take advantage of price dislocations in the peg on the open market.

For example, if USDC is trading at $1.02 on Binance, Alice can swap $100 of fiat USD for 100 USDC at Circle, transfer to Binance, and sell the 100 USDC for $102, pocketing a profit of $2 excluding trading fees and other transaction costs. With high liquidity across multiple exchanges and fiat on-off ramps, Alice's actions are replicated by other market participants (including whales), applying downward pressure on USDC's peg. Minor peg

issuance is low since to mint USDC on Ethereum; it simply issues more ERC-20 USDC.

However, let's examine the cost applied to custodial stablecoin peg maintenance in another area.

Custodial stablecoins are ostensibly bridges between TradFi and the crypto world. Since issuers like Circle hold reserves in regulated, real-world institutions, their custodian is much more vulnerable to directed regulatory actions. Maintaining a sufficient regulatory status to allay investor and holder concerns is a non-trivial cost — especially when issuers are relegated

manifestation of stablecoins and are accompanied by some compelling ideas around economic coordination at scale over a permissionless network.

Crypto-collateralized stablecoins are represented by the flagship stablecoin deploying the model, DAI, which is issued by the MakerDAO smart contracts. DAI is considered an "exogenous stablecoin" since its primary collateral, ETH, has uses outside of the stablecoin's peg maintenance — meaning ETH is not endogenous to the Maker system.

Maker is a money market built on Ethereum that enables depositors (e.g., lenders) to generate interest from borrowers. The rate is determined by

The mechanism of DAI issued as collateralized debt also induces scaling constraints since closed-cycle arbitrage is impossible. These scaling constraints typically manifest during market volatility, where Maker, as a lender, cannot respond to market swings adequately in real-time (providing non-market rates) due to high gas rates.

The result is that lagging liquidations either instantiate zero-bid auctions during extreme volatility or execute rapid, cascading liquidations of ETH collateral once the keeper system receives accurate market prices. A system shortage of collateral-backing the system results (in the case of March 2020, 5.5 million DAI), spiking the DAI peg to around $1.10 and stirring fear of the

Again, let's revisit the cost of peg maintenance.

Since Maker is a money market deploying over-collateralization of outstanding DAI, peg maintenance costs are high — manifesting as an inability to scale, collateral inefficiency, and the need to incorporate custodial stablecoins as collateral to dampen the negative externalities of market volatility.

Even though DAI is stable under normal circumstances, the costs for rebalancing the peg during volatility are highly contingent on a lender (Maker) avoiding a shortfall event — a cumbersome process compounded by

public blockchains under the duress of real market forces. Not to mention, under the stress of the extreme market volatility characteristic of crypto.

Do Kwon 🌔
@d0h0k1

The stablecoin is the most important product in crypto, uniquely serving the currency function of cryptocurrencies.

And the moon is the only asset that captures value from the rise of stablecoins 🌕

Bitcoin offers the elastic supply stability and conservative, ideological bed from which to tilt at the existing shackles of central banking. Algorithmic stablecoins aim to replace the suits and ties in boardrooms entirely — ushering in a new era of decentralized currency.

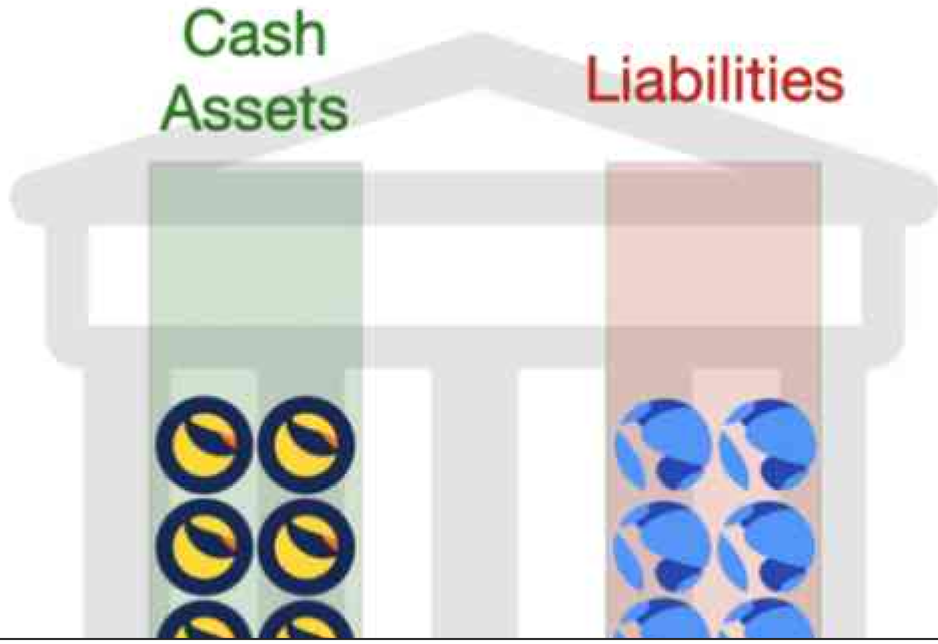
We cannot examine algorithmic stablecoins and Terra without first providing a high-level overview of central banks and how they manage various aspects of fiat currencies, so let's dive in.

Algorithmic Stablecoins — Eroding the Facade of Centralized Monetary Policy

expenditure to achieve a multiplier effect on money printed to stimulate growth.

However, there is the cost of contraction to the money supply during economic downturns, and even growth periods, where the prospect of inflation is an issue. Central banks have to absorb market volatility to defend against adverse collateral effects in the economy from the pegged currencies they issue. It's precisely why central banks are currently exploring CBDCs.

Deterministic, calibrated adjustments of economic parameters are more effective than fax machines and suits in boardrooms.


Cash
Assets
Liabilities

to market forces in real-time. As a result, algo stablecoins are designed to attain the trifecta of the long-term stablecoin goals without the trade-offs of the former two classes.

Primarily, this is accomplished via the "Seigniorage Shares" design of algorithmic stablecoins.

Rather than explicitly focusing on mint/redemption mechanisms to manage the elastic supply of the stablecoins, algorithmic stablecoins combine the mint/redemption mechanism with open market participation like central banks. They can operate with full reserves at a 1:1 ratio, fractional reserves,

Terra is an application-specific proof-of-stake blockchain using Tendermint consensus that's built on the Cosmos SDK.

The Terra network consists of a suite of fiat-pegged stablecoins (e.g., UST), supporting atomic swaps between stablecoins at their current market exchange rate to achieve shared liquidity — a buffer against falling demand in one currency relative to another.

LUNA, the native staking and governance token of Terra, is defined as the "mining power" of the system that absorbs the short-term volatility of the stablecoin pegs while furnishing long-term, counter-cyclical incentives to

The Terra protocol acts as a market maker with the on-chain swap mechanism using LUNA to make the market. Like central banks, Terra defends its peg with actions in the open market. But it does so indirectly via arbitrage incentives.

Most "seigniorage shares" algorithmic stablecoins follow a similar model but deploy more direct market activity, like Fei Protocol, which rebalances using liquidity on Uniswap. One explicit caveat also separates Terra — the Terra Protocol always enables on-chain swaps at the target exchange rate baked into the protocol, which is 1 UST for $1 worth of LUNA.

This is a necessary feature of algorithmic stablecoins that want to perform open market operations under real-time market stress. It's also what enables the "risk-free" arbitrage opportunity that helps alleviate peg discounts or premiums, where arbitrageurs leverage dislocations between the on-chain swap rate and UST price on the open market to pocket a profit.

Terra Seigniorage

If the increasing demand for UST causes it to trade above $1 on off-chain markets, arbitrageurs can burn $1 worth of LUNA to mint 1 UST on-chain, then sell the UST on the off-chain market (e.g., Kucoin) where UST is trading

In Terra, seigniorage is reinvested based on the Treasury_Weight module in the protocol, which adapts to different market conditions. In a standard scenario, the seigniorage is split as follows:

1. **A portion of the LUNA is burnt from the overall supply.**
2. **A portion of the LUNA is sent to the Community Treasury.**
3. **A portion of the LUNA is allocated to LUNA validators.**

More succinctly, the excess seigniorage from the swap from LUNA → UST (expansion of UST supply derived from increasing demand) on-chain is used

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mechanisms like issuing bonds and short-term debt instruments, hiking interest rates, and more.

The clandestine point, however, is that the expansion of the US money supply gradually dilutes holders of US Dollars — primarily long-term savers. Should dilution outpace savings rates (the current situation), then holders of USD are incentivized to enter risk-on markets like equities to generate a return on their capital rather than being persistently diluted.

In Terra, that contraction cost is burdened by the LUNA validators. Because they have bonded large stakes of LUNA into the network (with a 21-day

Rather than explicitly collateralizing UST, however, the system finances Terra price-making via LUNA. UST volatility is consequently transferred to LUNA. The protocol adjusts its calibration of specific parameters to make long-term LUNA prospects counter-cyclical to the short-term volatility of the price peg that LUNA absorbs.

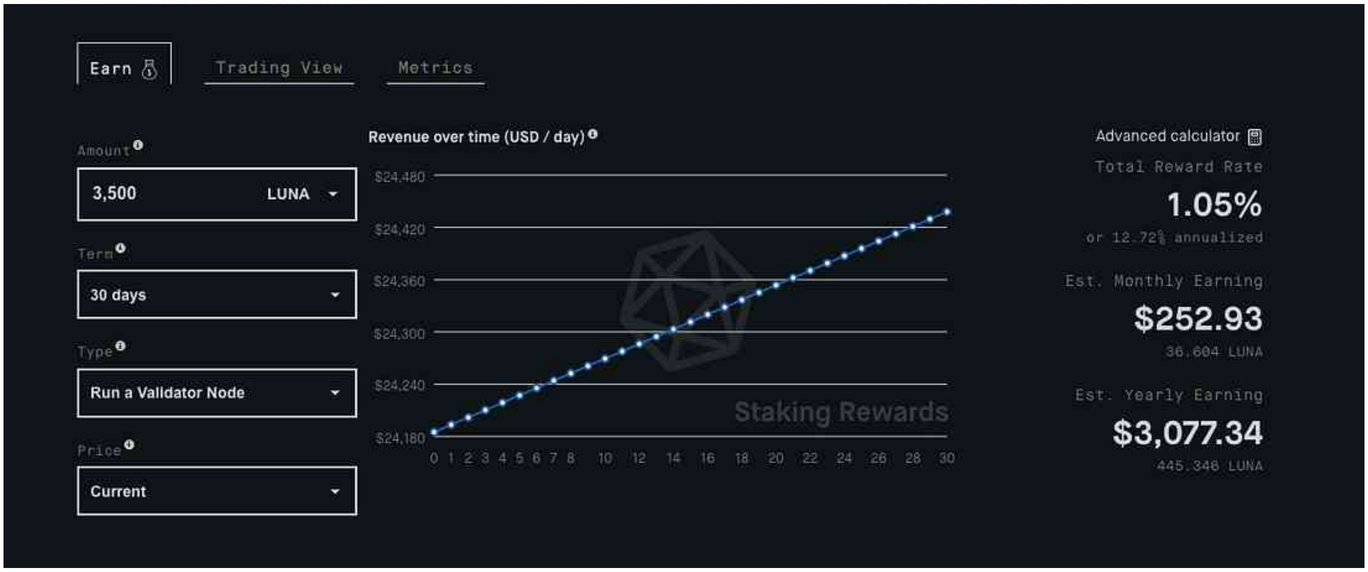
Hence, why the outstanding FDNV of the Terra ecosystem may be larger than the market capitalization of LUNA during intense periods of downward volatility. LUNA, not explicitly formulated to collateralize the outstanding liabilities of UST, can do so on a fractional reserve basis when necessary. LUNA just happens to get rekt more in the meantime until the system

1. LUNA validators are allocated bolstered staking rewards, resulting from increasing the tax rate on stablecoin transactions on the network.
2. LUNA validators' staking rewards are further augmented by increasing the on-chain swap fees for swaps from UST → LUNA (dampening the incentive to mint more LUNA on-chain simultaneously).

In the mid to long run, the protocol continues to buy back LUNA until the UST peg parity is reached. The overall result is predictable staking rewards under both expansionary and contractionary economic conditions.

The increased cash flows to LUNA validators are designed to nullify the


Daily Change In Luna Circulation Supply (millions)
19.82
3.22
0
-11.78
-26.78



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the long run, even if the growth is marked by short bursts of market volatility that trigger contraction.

Terra's resiliency is fortified by the broader notion of permissionless, open protocols relative to TradFi. When LUNA's price fell sharply from compounding liquidations on Anchor, triggering contraction, the peg still recovered within 48 hours.

Crypto experienced a massive VAR shock, a black swan, and nothing happened. No protocols failed, the system didn't break, socialized bailouts did not occur. Leveraged speculators lost money, protocols adjusted, DeFi

On-Chain Swaps — Oracle Manipulation Security

Prop 90, Jump Trading's second on-chain liquidity parameters proposal for Terra, again highlighted the idea of maximizing the redemption capacity of the on-chain swap mechanism while conservatively accounting for the possibility of oracle manipulation attacks.

Notably, the on-chain swap mechanism has explicit parameters designed to:

1. Maximize on-chain liquidity relative to off-chain liquidity.
2. Protect against oracle manipulation attacks.

1. **Minimum on-chain swap spreads of 0.5%**
2. **Tobin tax is variable with an average rate of 35 basis points (BPs).**
3. **On-chain liquidity redemption threshold of $20 million per day at 2% spreads with spreads increasing exponentially after that — incurring an excessive loss.**

The minimum on-chain swap spread of 0.5% is designed to stop front-running attacks when liquidity is low. Originally, the minimum spread was 2% and has been lowered to 0.5% as LUNA liquidity has increased. For more details about the Terra SDR cross-rate arbitrage trade, please refer to this

The reason is to reduce the attack surface by oracle manipulation of whales while commensurately maximizing the elasticity of Terra's stablecoin float — it's a careful trade-off.

From Jump:

"Conservative on-chain parameters can help protect the system from being bled by arbitrage or manipulation, but can also put a pretty strong cap on how much the float of Terra stablecoins can be increased/reduced by in a given time horizon."

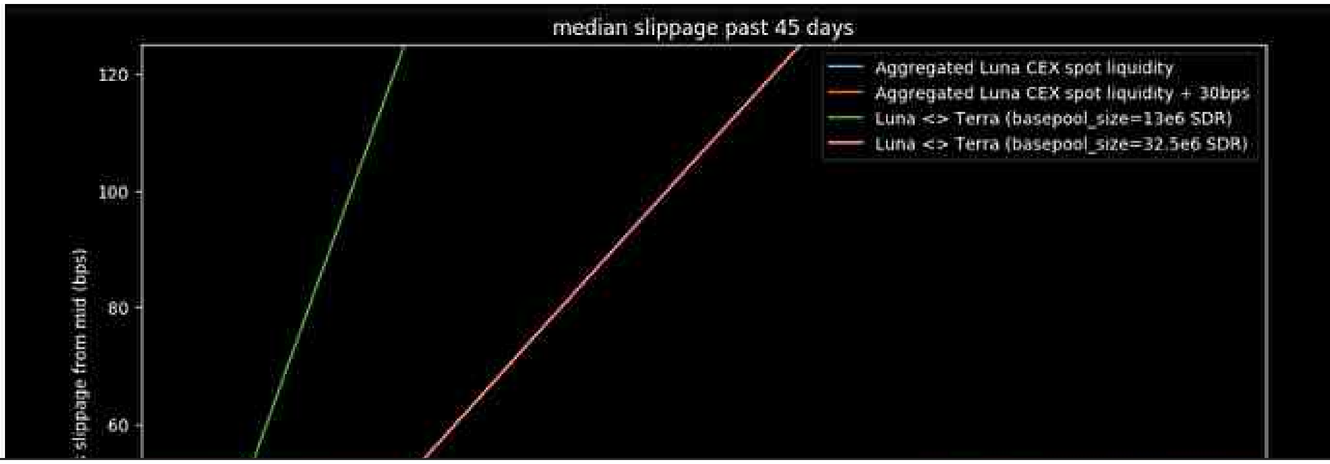
As off-chain liquidity for LUNA/UST increases, it becomes necessary to

Raise LUNA price off-chain -> Sell large amount of LUNA on-chain at high price -> Lower LUNA price off-chain -> Buyback LUNA on-chain at the reset lower price.

Make profit, rinse and repeat.

The above trade is profitable without an on-chain limitation as the whale can go from off-chain manipulation → on-chain profit repeatedly. With an on-chain limit (in the form of untenable losses from an exponentially accelerating spread), however, the size at which the whale can go from UST → LUNA has an upper bound.

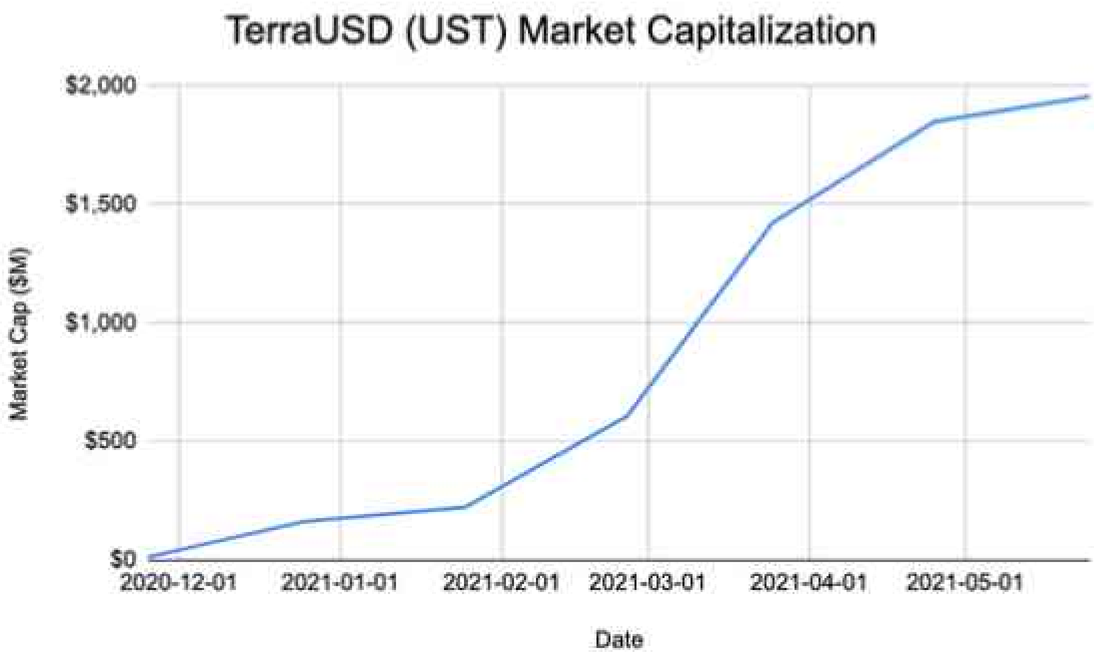
is always equal to or slightly more conservative — rendering oracle mispricing attacks fundamentally unprofitable.



roughly 30X. As a result, on-chain parameters need to be scaled up — accounting for increasing off-chain liquidity.

Without sufficient on-chain liquidity conservatively matching the expanding off-chain liquidity, LUNA cannot sufficiently absorb extreme volatility, dislocating the UST peg. Had Prop 90 already been live during the past weekend, volatility from excessive LUNA liquidations on Anchor would've been adequately absorbed on-chain, maintaining the UST peg.

The silver lining is that the 30X increase in off-chain liquidity reflects Terra's growth and expansion across CEXs and DeFi. It's a positive sign.


TerraUSD (UST) Market Capitalization
Market Cap ($M)
$2,000
$1,500
$1,000
$500
$0
2020-12-01
2021-01-01
2021-02-01
2021-03-01
2021-04-01
2021-05-01
Date

"I believe we can do much better than gold ever made possible. Governments cannot do better. Free enterprise, i.e., the institutions that would emerge from a process of competition in providing good money, no doubt would."

That vision was realized when an anonymous founder, Satoshi Nakamoto, unveiled the Bitcoin Whitepaper to a small mailing list of cypherpunks, unleashing a torrent of revolutionary financial exploration.

Replacing the vaunted guard of central banks, enwrapped in political asymmetries, with accessible, decentralized, open-source protocols is not for the faint of heart. Terra's protocol is a living organism. It's not in its final

Thanks to Stanford Liu and Irene Lee for their valuable input and feedback in the creation of this piece.

Addendum:

The original version of this piece contained a snippet derived from the Terra Whitepaper that the Terra Protocol will continue to buy back LUNA until the UST peg parity is reached with an upper bound of a 1 billion LUNA supply cap. The 1 billion LUNA cap from the original protocol's whitepaper is outdated, as LUNA dilution can theoretically continue until a discounted UST peg is restored to its $1 parity. The piece has been updated to reflect the

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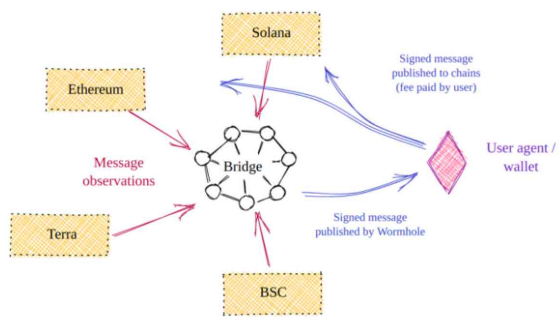

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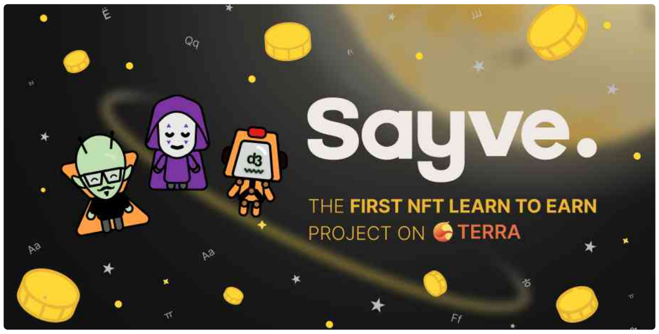

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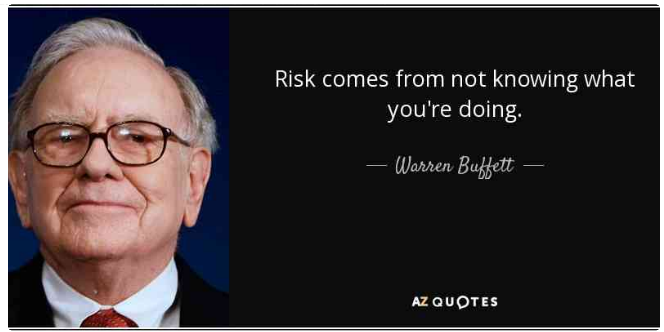

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